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ABSTRACT

Two alternative programs for students seeking secondary school teacher certification were compared for cost effectiveness. The most pronounced difference between individuals majoring in education and non-majors seeking teacher certification while completing degree requirements in their chosen field is the number of required semester hours of professional education coursework. Education majors are required to complete 12 more hours of professional education coursework than are non-majors. Each program requires a minimum of 48 semester hours of teaching field coursework. The cost effectiveness of the 12 semester hours required of education majors was analyzed. An analysis of costs (faculty, materials, equipment, facilities, and services) revealed that, from the college of education's perspective, the certification option was less costly than the program for education majors. An analysis of student teachers' impact on student achievement revealed that education majors achieved a 10 percent higher increase in pupil cognitive attainment. The findings indicated that it costs $73 more per semester per education major to positively effect a 10 percent gain in pupils' cognitive performance. The implications of these findings for program developers are discussed. (JD)

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A Cost Effectiveness Evaluation of Alternate Secondary Level Teacher Preparation Programs

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Most studies to date of educational programs have considered separately either program costs or program outcomes, but usually not both within the same analysis. Treating costs without consideration of outcomes results in knowing which of several alternatives are least expensive, without knowing whether any of them produce the desired outcomes. Treating outcomes without attention to costs can result in selecting program alternatives that are only marginally more effective, but exorbitantly more expensive than other alternatives. Only by incorporating both costs and outcomes within comparative studies of program alternatives can one reliably determine which alternative is most effective for a given cost, or how much it would cost to obtain a desired level of effect.

A few writings designed to help researchers use cost-effectiveness analysis in program evaluation do exist. Alkin (1970) provided an early chapter advocating its use in the evaluation of instructional programs. Levin (1975) provided a sound general introduction to the topic, followed by an instructional analysis of specific applications in educational evaluation (Levin, 1981). Thompson (1980) also discusses the use of cost-effectiveness in his volume on benefit-cost analysis in evaluation.

A cost-effectiveness analysis thus involves the comparison of two or more program alternatives which can be compared on similar outcome or effects measures such as test scores, performance ratings, and so on. The incorporation of cost data enables one to consider the interplay of both costs and effects in reviewing program operations.

The Present Study

While there have been a number of studies on the effects of the two alternative programs leading to secondary teacher certification (cf. Denton and Morris, 1981; Denton 1980, 1981; Denton and Norris 1979, 1980, 1981; Denton, Morris and Tooke 1982; Denton and Lacina 1983), there has, as yet, been no attempt to combine this effects information with program costs. That was the intent of this study.

The present investigation seemed warranted for several reasons. First, previous effects studies have suggested that important differences exist between the two alternative preparation programs. Having more professional education courses seems to improve a student's teaching ability, but how expensive is the increased performance to the student, the department, and the college? Second, there is currently an ideal opportunity available to study the relative costs and effects of the two programs since there exist "natural" comparison groups which have participated in the in-place and stable program alternatives. In other words, a natural comparative design already exists. Finally, since future changes to the teacher preparation program are being contemplated, including the possibility of an extended program, the time is right to do some preliminary study of the costs of the existing alternatives. Although the present study does not address the potential effects or costs of possible future alternatives, the results of this investigation should provide useful background and possibly suggests, information for use in designing future alternatives.

I. Description of the Alternative Programs

Program Rationale

This investigation was conducted under the auspices of an educational curriculum and instruction (EDCI) department at a land grant university. The teacher preparation programs which were studied in the investigation are competency based programs for secondary level teachers fashioned around a diagnostic prescriptive model of instruction (Armstrong, Denton, Savage, 1978). This model conceptualizes teaching as a series of events requiring five distinct sets of instructional skills, that is: Specifying Performance Objectives, Diagnosing Learners, Selecting Instructional Strategies, Interacting with Learners, and Evaluating the Effectiveness of Instruction.

This model provides a framework that encourages the development of individual teaching styles. Individualized styles are encouraged because evaluation of instruction is based on learner attainment of performance objectives. Given this operating principle, teachers in preparation are free to choose procedures from their own repertoires that they believe will result in high levels of learner performance. Further, teacher responsibility is well served by this model. This responsiblitiy comes not because of the teaching candidates's adherence to a set of "ideal role behaviors," but rather in adapting instructional practice, as necessary, to help learners achieve performance objectives that have been selected.

Program Course Offerings

In contrast to the commonalities among the two teacher preparation programs, in teacher education, the most pronounced difference between individuals majoring in education and non-majors seeking teacher certification while completing degree requirements in agriculture, liberal arts, or science is the required semester hours of professional education coursework. Non-majors complete 22 semester hours of professional education coursework, while majors complete 34 semester hours. In addition, each program requires a minimum of 48 semester hours of teaching field course work. The following table illustrates the professional education coursework required for both programs.

The primary cost analysis question in this inquiry is the cost effectiveness of the additional 12 semester hours required of education majors. On the cost side, because 5 additional courses are required, offering this program is more expensive for the college than providing the certification program. On the effects side, the education major program is more effective in producing pupil cognitive gains during student teaching than is the certification program, yet supervisor ratings and self-report morale ratings of student teachers are essentially equal across the two programs.

Table 1
Professional Education Coursework Required by Secondary Teaching Candidates in Alternate Preparation Programs

Semester	Major in Education Program	Certification Program
Second	EDCI 120 (1 hr) Introduction to Teaching	----------
Third	EDCI 220 (2 hr) Early Field Experience	----------
Fourth	EDCI 221 (3 hr) Subject Matter of Teaching	----------
Fifth	EPSY 301 (3 hr) Educational Psychology	EPSY 301 (3 hr) Educational Psychology
Sixth	EDCI 323 (3 hr) General Methods of Teaching	EDCI 323 (3 hr) General Methods of Teaching
	EDCI 321 (3 hr) Adolescent Psychology	----------
Seventh	EDCI 401-7 (4 hr) Teaching Field Methods	EDCI 401-7 (4 hr) Teaching Field Methods
	EDTC 405 (3 hr) Preparation of Instuctional Materials	----------
Eighth	EDCI 425 (12 hr) Student Teaching	EDCI 425 (12 hr) Student Teaching

II. Description of Costs

Data were gathered for the cost categories: administration, management, faculty, materials, equipment, facilities and services. Since effects data were gathered from 1978-80, it was felt comparable cost data spanning 1976-80 would be appropriate, spanning the expected eight semester period necessary to complete an undergraduate degree.

Administrative costs were determined for the dean's staff, the department head, and coordinator of field experiences, since each of

college or office of university planning sources.

Costs associated with Services including costs for telephone, printing, mail and computer were obtained from departmental operating expense allocations. Again, those costs were adjusted to reflect costs expended for the secondary program.

Table 2 presents a summary of total costs over an eight semester period (fall 76 - spring 80) for the two programs in secondary teacher education. From the perspective of the College of Education, the certification option is less costly than the program for education majors, i.e., $47,913, compared with $79,935. Ironically, the total costs during the fall semester of 76 and the spring semester 80 are not too different for secondary majors, yet larger fluctuations occurred during this time period, e.g., spring 78 - $98,594 to $68,147 - fall 79. This large variation in costs during the eight semester period reflects the fluctuations in undergraduate enrollment in secondary education in comparison to total enrollment in EDCI.

Table 2

Semester Cost Comparisons of Two Programs in Secondary Teacher Education

Semester	Majors	Non-Majors
Fall 76	70,337	48,625
Spring 77	85,113	56,728
Fall 77	79,734	47,290
Spring 78	98,594	49,562
Fall 78	78,329	49,522
Spring 79	83,288	48,718
Fall 79	68,147	39,448
Spring 80	75,938	43,411
Total	$639,480	$383,304
Average	$ 79,935	$ 47,913

these administrative units were responsible for different aspects of teacher preparation. Administative budget allocations were adjusted for each unit to reflect the unit's administrative contribution to secondary education.

Management costs obtained for this evaluation included salaries of secretaries and program coordinators whose tasks and supervision directly influenced secondary teacher preparation. Cost values for coordinators in secondary education and field experiences were determined by adjusting their faculty salaries in terms of the contribution their management function influenced their semester teaching loads.

Faculty costs for individuals teaching the required coursework in secondary education were obtained from the department heads of educational curriculum and instruction, educational psychology, and industrial education (educational technology). Salaries of faculty were adjusted to reflect the proportion of their teaching load devoted to secondary education.

Materials costs and equipment costs were obtained from departmental operating expenses. As with other costs, these expenses were adjusted to reflect the resources expended for the secondary program. This adjustment was accomplished by multiplying semester costs by the ratio of secondary students to the total number of education students.

Facilities costs were determined by the "shadow cost" technique, that is, the expense of renting space from a local government or private facility to hold class. This technique was used because information on facility use was not available from departmental,

III. Description of Effects

As described previously, two alternative programs exist for students desiring to obtain secondary teacher certification. How do these alternatives compare in terms of instructional effects? Is one alternative more effective in producing the desired student gains than another? These are the basic effects questions.

The culminating experience for both preparation programs is a full-semester, full-day student teaching program with twelve semester hours being awarded for successful completion of the experience. During this course, each student teacher is required to develop and implement two instructional units, each requiring approximately two weeks to complete. The instructional units are to include: performance objectives, a diagnostic pretest to determine if prerequisite knowledges and skills are present, instructional strategies addressed to each performance objective, and criterion-referenced instruments. These units must be approved by the classroom supervising teacher and the university supervisor prior to their implementation. Some time ago, a multi-stage evaluation system was established to monitor the development and implementation of these competency-based programs (Denton, 1977). Evaluation of student teachers in this system includes supervisor ratings based on in-class observations and ratings of instructional materials produced by the student teacher. Generally, six supervisor visits are completed during a semester. These visits are recorded as ratings on an Evaluation Profile instrument. It may be of significance that the final evaluation for each student teacher

recorded on this instrument represents a consensus rating resulting from a three-way conference between the student teacher, the classroom supervisor, and the university supervisor. In addition, a Curriculum Context Checklist for rating the components of each instructional unit is completed by the university supervisor. Two of these forms are completed during the field experience. These rating scales provided effects data for this inquiry. In addition, summative procedures are conducted by student teachers at the conclusion of each unit, and summaries of learner performances are recorded on Summary Evaluation Unit Forms. Values for this form are obtained as student teachers retain the unit test responses of learners after providing feedback to them regarding their performances. Copies of these instruments are available in ERIC (Denton & Norris, 1979).

The aforementioned learner performance data were subsequently used to develop a criterion-referenced summary on each learner and summarized as group values for each student teacher. Subsequent analysis of these data revealed differences in performance among learners depending on the major of the student teacher (Denton & Norris, 1979; Denton & Tooke, 1982) which in turn, stimulated this inquiry.

Sample

Information from 82 secondary-level student teachers and 9001 learners taught by these student teachers comprised the total sample for the effects data base. Fifty-five of these student teachers were education majors, while the remaining 27 candidates were teacher certification students majoring in other colleges.

It is important to note that the major of the student teacher was not known by the university supervisor during the field experience. In addition, a contingency table was developed and statistically tested to determine whether student teachers were evenly distributed across university supervisors with respect to their academic majors. This comparison was not statistically significant, indicating expected numbers of student teachers of each category (majors and non-majors) were, in reality, assigned to each university supervisor. Even though these precautions were taken, certainly no claim can be made that educational effects from this inquiry will generalize to other settings.

Upon checking transcripts of this sample, it was determined that the average number of semester hours of former education majors and former certification-seeking students were 144 and 155, respectively. Further, education majors completed 34 semester hours in professional education, while certification students completed 24 semester hours in education. These values roughly correspond to the requirements presented in Table 1.

Results

Because of the numerous comparative studies already conducted of the effects differences between education and non-education majors in these programs, no attempt will be made here to review in-depth all the past research. Instead, we will simply restate the major findings from these studies and refer the reader to the existing technical reports for further details.

One major criterion used to assess the relative performance of the education and non-education majors was the cognitive gain made by their pupils during the student teaching experience. An unexpected finding from this research has been the phenomenon that the academic major of the student teacher appears to account for variation in cognitive attainment of learners of those student teachers. To illustrate, a modest correlation (r pbi= .23) was determined between the academic major of the student teacher and cognitive attainment values of their learners on the second unit taught by the student teachers. Further examination of the data revealed that learners of education-majors attained higher average cognitive attainment values ($x = 69.0$) than learners of non-education majors ($x = 58.9$). These values were somewhat surprising because cognitive attainment means associated with unit one for the two groups of learners were nearly equivalent, 67.6 and 67.3 for learners of education majors and non-majors, respectively (Denton & Norris, 1979).

An examination of grade point ratios in professional education coursework and teaching fields was addressed in an investigation by Denton, Morris and Tooke (1982). Specifically, the effect of academic achievement of student teachers on learner cognitive attainment was examined. Zero-order correlations of learner cognitive attainment with student teacher grade point ratios ranged from -.03 to .06 indicating virtually no relation between grade point ratios of the student teacher and the cognitive attainment of their learners. Moreover, grade point ratios over all college coursework completed by the teaching candidates were found to differ only slightly between education majors

(GPR = 3.00) and non-majors (GPR = 2.89) (Denton, Norris 1979).

Another variable, time-allotted-for-instruction, was examined by Denton and Norris (1979) with respect to the major of the student teacher. They report student teachers who were education majors allotted 621 minutes for teaching their initial instructional unit, while student teachers who were non-majors allotted 657 minutes for their first unit. In the case of the second instructional unit presented by the student teachers, education majors allotted 547 minutes to 408 minutes for non-majors. While the allotted time in the first unit was greater for student teachers who were non-majors (approximately a half-period longer), the situation was reversed for the second unit with student teachers who were majors planning longer units (approximately 2 periods longer). The findings for unit two are consistent with teacher-effectiveness research literature because learners of education majors, who attained higher cognitive values, were provided a greater amount of time for direct instruction.

Differences in supervisor ratings of instructional skills between the two groups have also been examined (Denton and Lacina, 1983). For three of six evaluations, ratings by university supervisors during the student teaching experience were found to be significantly different. Ratings of student planning effectiveness revealed little variation across the student teaching period regardless of major, although without exception, the non-majors received higher ratings on the initial instruction unit they presented, while education majors received higher ratings on their second unit. In terms of instructional competence, the differences in ratings between education

majors and non-education majors have tended to be small. Non-majors consistently obtained higher ratings on the use of duplicating and audiovisual equipment, while majors attained uniformly higher ratings on introducing and concluding lessons. Thus, although the ratings in some cases show differences between the two groups, the results are mixed. The supervisory ratings do not uniformly favor one program alternative over the other in terms of instructional skills.

A fifth variable used to study the effects of the alternative programs has been the morale of students during the student teaching process (Denton and Lacina, 1983). In this case, no significant differences have been found between education and non-education majors, suggesting that the programs are equally effective in influencing student morale.

In summary, it appears from previous studies that the education major alternative is more effective in producing pupil cognitive gains during student teaching than is the non-major alternative, that the alternatives are differentially effective in influencing instructional skills as measured by student teaching supervisors, and result in no discernable morale differences during student teaching. In terms of effects, then, the results are mixed, except that the education major alternative seems clearly more effective in producing pupil cognitive gain.

IV. Conclusions

Summary

Recounting significant costs and effects of the two preparation programs available to university students seeking certification as secondary teachers leads us to the following observations. Costs of the programs expressed in terms of total costs/semester revealed that the education majors program was 1.67 times more expensive than the certification alternative, that is, $79,935/semester compared with $47,913/semester. Yet when the number of students enrolled in the different options were factored into the costs, a substantial shift occurred, with the education major program being one-fourth as expensive as the certification program, i.e., $182.58 per sem/student majoring in education -vs- $700.48 per sem/student enolled in the certification program. Certainly these variations in costs reveal the impact of the number of students enrolled in the two program alternatives. In one sense, the certification option could be considered a "free-program," since all course requirements of this program are included in the secondary majors program for teacher education, and the required coursework must be provided to the student regardless of the program in which she/he is enrolled. Yet, the number of students completing secondary teaching certificate requirements as non-majors has influenced costs to the College of Education through increased sections of courses, additional advisement and additional supervisory expenses. Thus, the logic of comparing total program costs/semester factoring in the number of students being served

provides useful information, especially when the effects findings are taken into account.

The finding that learners of education-majors attained higher average cognitive attainment values ($x = 69.0$) than learners of non-education majors ($x = 58.9$) during the second unit taught by the student teachers, suggests the program alternatives are producing quantitatively different teachers, at least through the student teaching experience. Expressed differently, it appears that a 10 percent difference in learner cognitive attainment is associated in some fashion with the type of teacher preparation program completed by the student teacher. However, other "effects," such as supervisor skill ratings of instructional planning and implementation were mixed, with differences in ratings between education majors and non-majors being small. The supervisory ratings simply do not uniformly favor one program alternative over the other in terms of instructional skills. In the case of morale ratings of student teachers, no significant differences were found between student teachers enrolled in the alternative programs, suggesting that the programs are equally effective in influencing student teacher morale.

Combining the cost and effects findings in this investigation yields the observation that it costs an additional $73.14/semester for a student teacher in secondary education to increase the cognitive attainment of their learners by 10 percent in their second unit of instruction. Is this cost/effect ratio reasonable? Answering this question assumes that comparative costs from other programs are available. Unfortunately such cost-effectiveness information is not

available, at least not to our knowledge! However, a conjecture about the reasonableness of spending $73/sem to positively affect a 10 percent gain in cognitive performance will be made. Given the difficulty in identifying methods and techniques of instruction, as well as curricular organizations which have been found to produce cognitive gains in learner performance, the effects of this line of inquiry are encouraging. Since the 10 percent value is an average of a class of learners, not a single learner, this yield should be multiplied by the learners taught by the student teacher. Under these conditions, spending an additional $73 per semester in the preparation of a teacher becomes a modest cost item.

Implications

This investigation has linked "program effects" with cost data for alternate programs in secondary teacher preparation. This linkage represents a significant relationship which department heads and Deans in Colleges of Education are sensitive to in these times of financial shortfalls and press releases on quality deficiencies in teacher preparation. Results from this inquiry can be applied as baseline indicators of cost/effect units when futures program revisions are being considered, and as a means of comparing start-up costs -vs- operational costs for a program. In particular, the outcomes of this inquiry, i.e., a 10 percent increase in learner cognitive attainment costs an additional $73 a semester per student, may have direct implications for whether teacher education programs should consider extending their preparation period for teachers. If the press is for

quality, with costs being secondary, these findings provide encouraging information to program developers. However, if costs are primary, and quality effects are secondary, these findings should serve as caution indicators to the development team. At the very least, integrating costs with effects provides additional information for program decision-makers to use in reaching summative decisions about their teacher education programs.

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